70755A INTERFACE

OPERATING MANUAL

used on Guildline 9577 / Schlumberger 7075

JUNE 81

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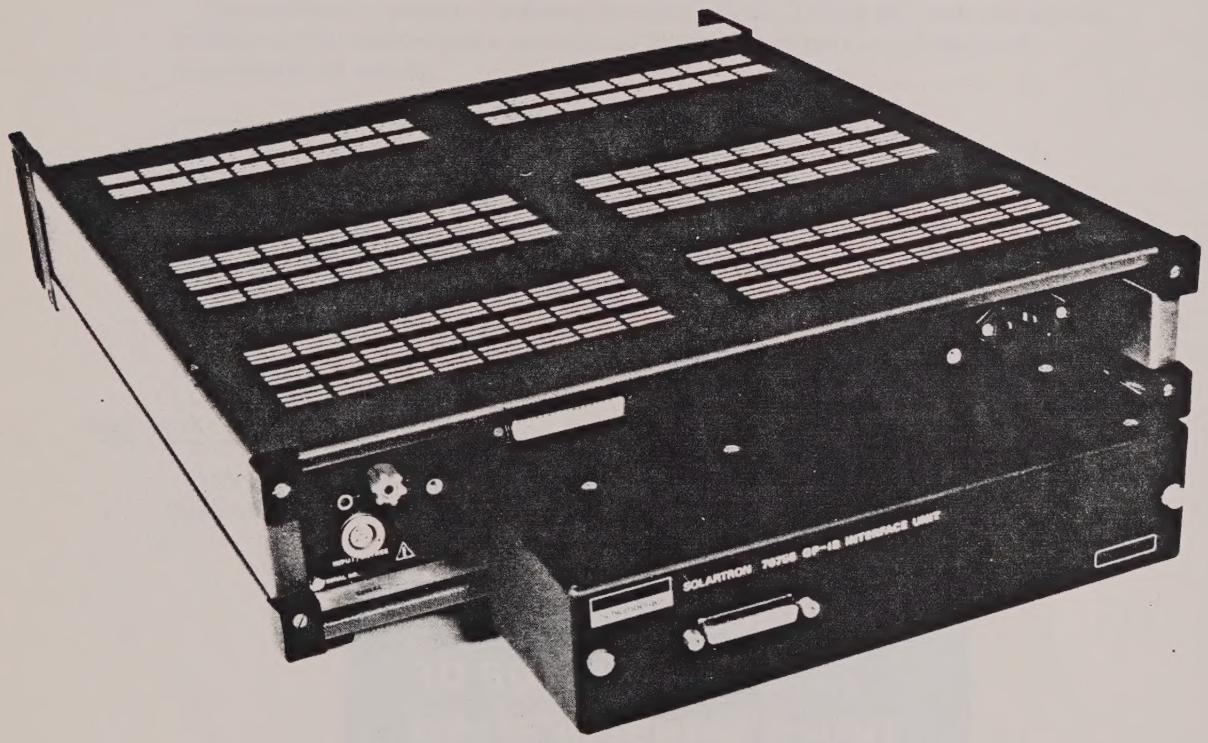
OPERATING MANUAL



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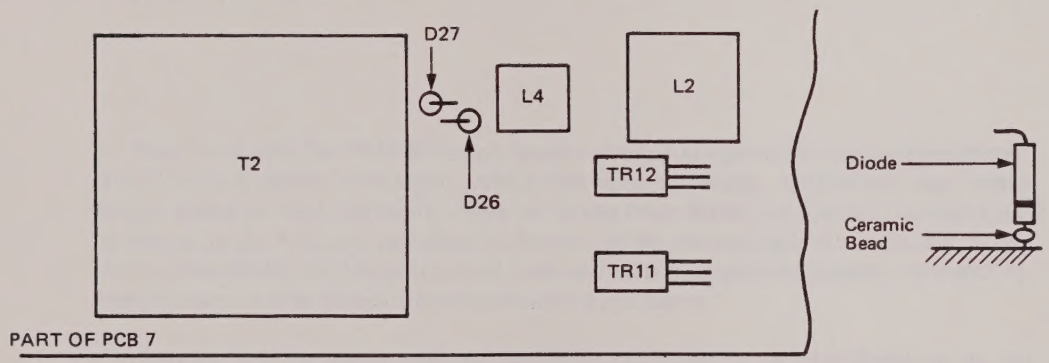
The specification in this document may therefore be changed without notice

IMPORTANT NOTE

The user of the 70755A Interface Unit is advised that some early models of the 7075 Maestro dvm are not wholly capable of powering the Interface. Malfunctions and/or excessive heat dissipation will be experienced unless a simple modification is made to the instrument's power supply circuit.

The modification consists of replacing the existing diodes D26 and D27 with type IN5821, which should be mounted with a ceramic bead between the component and the board, (illustrated in the sketch).



This modification is being implemented retrospectively on later instruments. Modified dvm's will carry a label as illustrated, fixed to the rear panel.

POWER UNIT BOOSTED
TO SUPPLY 70755
GP-IB INTERFACE UNIT

A user of the earlier, unmodified instrument who wishes to employ the 70755A Interface, should request assistance from the nearest Service Centre or from Solartron at Farnborough.

Now, fitted with the GP-IB Interface, Maestro emerges as a powerful computer peripheral. The 70755A is capable of interfacing with a wide range of devices. Applications range from a simple system in which the dvm is connected to one other device, say a printer; through a small system of up to 14 devices, including the Maestro, under the command of a controller, to an ATE system which could employ several buses and their associated instruments controlled by one processor or even several intercommunicating processors.

Using the 70755A, Maestro will talk directly in ASCII code to the other devices on the bus. The firmware in the Interface carries out the conversion and the formating of the measurement data. A floating point format ensures ready assimilation by practically any computer. Similarly, ASCII-character instructions from the controller are interpreted by the Interface for implementation by the dvm.

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INTRODUCTION

The 70755A implements the IEC TC66 Byte Serial Bit Parallel specification enabling the Maestro 7075 dvm to be interfaced into any data bus satisfying the specification.

Goldline 9577

Control information on the bus takes the form of bus messages and device dependent messages. Bus messages are used to: control the LOCAL/REMOTE state of the dvm, command the dvm to either talk or listen, enable/inhibit the front panel buttons of the dvm, clear the dvm to its power up state. Device dependent messages control the operation of the dvm.

In the following description sample programs are included to demonstrate the various uses of the bus and device dependent messages. It should be noted that the format of the bus control assumes the use of an HP9825A calculator. Reference should be made to the controller handbook to obtain the precise format if other controllers are used.

Throughout the following description zero is written as ∅ where necessary to differentiate between zero and the letter O.

The ASCII code is given in tabular form in an Appendix to this manual. The table shows the significance of the columns in terms of the IEC TC66 Standard.

The following specification facilities are implemented:

a. LOCAL/REMOTE, all facilities.
b. Terminal TALK and LISTEN modes addressable.
c. Serial Poll fully implemented.
d. SDC and DCL (Device Clear).
e. GET (Group Execute Trigger).
f. 25 way D-type connector as per recommendation.

Additional features of the Interface are:

a. Fully programmable dvm.
b. Full resolution of measured data output.
c. Error detection of input message strings and echo back remote settings for verification.
d. Output parity selection.
e. Talk and listen only modes for use with simple systems.
f. Flexible data output format with easy to read and understand format. Data output is in common units i.e. V, mV, μV etc.
g. Printing ASCII only input/output for use with maximum number of controllers (from TTY to large computer).
h. Access of all measurements settings and results including front panel controls.
j. Flexible measurement rate facilities for slow to fast peripherals.
k. Interrupt on sample completion.

DVM CONTROL – LOCAL/REMOTE

Full LOCAL/REMOTE control as defined by the IEC standard is implemented in the 70755A. Both LOCAL and REMOTE may be programmed as well as front panel lockout providing full LOCAL/REMOTE flexibility.

The GP-IB (General Purpose Interface Bus) always has overall LOCAL/REMOTE control. The bus signal REN (Remote Enable) is released to set all devices on the GP-IB to LOCAL. Asserting this bus signal enables any device to be programmed to a REMOTE or LOCAL state on receipt of the bus messages MLA (My Listen Address) or GTL (Go To Local) respectively. If the front panel LOCAL/REMOTE buttons are enabled REMOTE must be pressed to enable the GP-IB to program the REMOTE state; these buttons may be disabled by receipt of the bus message LLO (Local Lockout) giving the bus full control through the messages MLA and GTL.

A $\overline{\text{REN}}$ signal of duration > 20ns will clear the LLO state and set the dvm to LOCAL.

The local/remote state of the dvm is shown by the illumination or otherwise of the REMOTE annunciator on the front panel of the instrument.

The user must refer to the Controller Manual to obtain details of the particular implementation of the bus LOCAL/REMOTE *facility applicable to his controller.*

LOCAL

When in LOCAL the dvm function, range etc. is controlled from the dvm front panel buttons. Measurements are triggered by the SINGLE or REP buttons in the normal way. It is possible to output the measured data to the bus by addressing the interface to TALK; the data output will be that resulting from the last completed measurement. It is therefore possible to use the dvm as a bench controlled instrument and also access data for post-measurement processing or analysis. LOCAL is always entered when the dvm is powered-up.

All facilities provided by the N, H, Q and E device dependent message strings are available in LOCAL operation of the dvm. These provide the following facilities to the user:

a. to alter the format of the data output

b. to adjust the sample rate of the dvm to suit the speed of a listening device

c. to use the SRQ (Service Request) interrupt facility to detect sample completion

d. to echo-back front panel settings of the dvm for data logging purposes.

The following example illustrates the sequence of events required to place a dvm in LOCAL, enabling the user to set up and obtain the required measurement, and then obtain a print-out of this measurement together with the associated front panel settings.

	Program Step	**Action**
Ø:	dim X$ [1ØØ]	*A string variable. Allocates a 1ØØ character storage area within the controller for voltmeter data.*
1:	clr 717	717 *is the controller code for the device address of the 70755A on the bus. This instruction sends the bus message* SDC *(Selected Device Clear) to clear the dvm and Interface to the power-up state.*
2:	lcl 7	*Releases the* REN *signal setting all instruments on the bus to* LOCAL. *The user may now set up the dvm as required and initiate measurements. Any number of measurements may be made as the* HØ *mode is in operation by default.*

3:	red 717, X$	*Sets up the bus data path, by sending the bus messages* MTA *(70755A) and* MLA *(controller). Data is then input from the 70755A, into the controller, The data input will be from the last completed measurement.*
4:	prt X$	*Outputs data string to printer.*
5:	wrt 717, "E1"	*Sets up the bus data path by sending the bus messages* MLA *(70755A) and* MTA *(controller). This is followed by device message ASCII character* E *followed by 1 which causes the 70755A to assemble the dvm settings from the previously completed measurement.*
6:	red 717, X$	*Inputs the echo-back string assembled by line 5 into the controller.*
7:	prt X$	*Outputs setting data to printer.*
8:	gto 3	*Returns to line 3 and repeats.*

The printed data will be of the form:

VDC +1.2Ø3ØØØØE+ØØ
M3R5D1QØHØNØPØTØ

Remote control settings (Measurement function, Range and Display resolution) are stored within the 70755A Interface. If device dependent messages, that alter these settings, are received by the Interface when in LOCAL the stored settings are updated. When the dvm is switched to REMOTE these stored settings are used to set up the REMOTE state.

REMOTE

In REMOTE the dvm settings are controlled entirely from the bus via the Interface. The dvm is only in REMOTE when the REMOTE annunciator on the front panel is lit.

Instrument settings are programmed by sending messages to the interface when it has been addressed as a bus listener. Each setting is defined by an ASCII letter to define the setting type (e.g. mode, range) followed by an ASCII number to define that setting. e.g. The message M3D1RØ sets DC volts 4 x 9's resolution and Autorange.

Samples are triggered in various ways defined by the Trigger mode in operation. Single and Repetitive sample are available as well as single and repetitive initiated by the bus command 'GET' (Group Execute Trigger).

In the same way as in LOCAL, sample rate can be adjusted to suit the speed of the listening device by selecting Handshake mode 1.

It is possible to access the settings information from the previous measurement and the existing REMOTE settings. The recalled settings may be used to verify REMOTE programming strings. The following example shows how single samples may be programmed with message string verification and sample data print out.

	Program Step	Action
Ø:	dim X$ [1ØØ]	*Allocates storage area as in previous example.*
1:	clr 717	*Sends the bus message* SDC *(Selected Device Clear) to clear the dvm and the interface to the power-up state.*
2:	rem 7	*Asserts* REN *signal to enable* REMOTE.
3:	llo 7	*Sends the bus message* LLO *(Local Lockout) to disable the dvm front panel buttons* LOCAL/REMOTE.
4:	wrt 717, "M2RØD1E2":	*Addresses the 70755A to Listen and sends the device message (ASCII characters)* M2RØD1. *This sets up* AC, Auto range, 4 x 9.s *resolution. The ASCII character* E2 *causes the Interface to assemble the received data for echo-back.*
5:	red 717, X$	*Sets up the bus data path and inputs the echo back data to the controller, into variable X$.*
6:	if X$ [1, 6] # "M2RØD1": prt 'error'; stp	*Compares the first 6 characters in the echo back data with the data sent by line 4.* *If these do not compare the word error is printed and the program halts. If they compare the program continues to line 7.*
7:	wrt 717, "T2"	*Sets the dvm to Listen and sends the device message (ASCII characters) T2 causing the dvm to execute a single sample.*
8:	red 717, X$	*Inputs the data from the single sample when completed.*
9:	prt X$	*Outputs data to the printer.*
10:	gto 7	*Returns to line 7 and repeats.*

Summary of Local/Remote Control Facilities

70755A fully complies with the IEC/IEEE Standards for Local & Remote control.

When using the Maestro within a GP-IB controlled system the dvm front panel LOCAL/REMOTE push buttons can be used normally, or in conjunction with controller messages, or can be totally overridden.

Local Lockout. The controller can prevent Local operation of the dvm (from the front panel controls) by asserting the command LLO to the bus. This command disables the front panel buttons, and will even override the dvm LOCAL selector. To return the dvm to Local operation the controller will send GTL together with the address code of the dvm.

Local operation. The dvm will revert to LOCAL when either GTL is received, or LOCAL is selected by means of the front panel button. In this state the response or otherwise of the dvm interface to management signals on the bus is governed by the rules of the GP-IB.
N.B. LOCAL is the state always assumed when 7075 is first switched ON, in this configuration.

Remote operation. After receipt from the controller of REN (Remote Enable), provided that LOCAL is not selected by the front panel button, the message MLA (my listening address) will cause the dvm to assume Remote operation and the REMOTE annunciator will be lit.

PROGRAMMING THE DVM FROM THE BUS

Programming the dvm from the bus consists of addressing the interface to listen by sending the bus message MLA (My Listen Address) by means of: wrt 717, (for example).
Device messages may then be sent to the Interface, these consist of pairs of ASCII characters, a letter followed by a single number. The letter selects a particular setting, the number selects the setting parameter. Any number of ASCII numbers may follow a letter, however, only the last valid number is used to select the parameter e.g. M2 selects AC volts function and M21Ø3 selects DC volts function (M3).

Each character following a valid setting letter is checked, any character which is either non-numeric or is outside the valid range for it's preceding letter is ignored* and an error interrupt is generated. This indicates to the controller that an error has occurred.

The error interrupt may be ignored to allow extra characters to be included in the device message strings.

e.g. MSp+2.1Sp will set up the KOHM function M1 even though several illegal characters have been included. Sp represents the ASCII character-space.

The order in which the different settings are programmed is generally not critical. It is good programming practice however, to include the following two actions in all programs:

a. Precede each setting string with TØ. This is because each setting is changed immediately on receipt of the relevant characters, TØ inhibiting further samples while the settings are changed.

b. Terminate each setting string with the required trigger mode, to initialise the selected measurement sequence.

There are, however, no restrictions on making a setting change during a sample if required and no erroneous data will be output.

Messages applicable to both LOCAL and REMOTE operation

N – *Numeric output format*

The normal format for data output by the interface is, for example:

VDC +6.5432100E+00 CR LF

which represents 6.54321V dc.

If the controller in use is unable to accept the initial 'Alpha' characters it is possible to suppress them by programming Numeric format ON. This is done by sending the ASCII string N1 to the addressed interface. The above format would then be modified to:

+6.5432100E+00 CR LF

NØ enables the Alpha header characters.

N1 suppresses the Alpha header characters.

Suppressing the alpha header characters may be useful in fast logging applications where maximum data rates are required. A reduction of 27% in the required data transfer time is achieved if the 6 alpha characters are suppressed. The NØ option is selected on power-up and by the Device Clear function.

*Illegal settings cannot be implemented as a result of invalid characters. Should a non-valid setting character occur the settings will remain as set by the last valid programming string received.

H – *Handshake facility*

Two sample Handshake options are available. The message HØ allows the dvm to measure at its selected rate unimpeded by the bus sample data transfers. Data output will be that from the last completed sample. Any sample which occurs while data are being output to the listening device is ignored by the interface.

The message H1 allows the listening device to determine the sample rate. This mode is normally used with repetitive trigger modes and it synchronises the measurement sample rate to the listening device data rate. After a sample is completed the dvm is inhibited from starting a new sample until the current data are output.

The following example illustrates the use of the H functions in REMOTE.

	Program Step	**Action**
Ø:	dim Y$·[8Ø]	*Another string variable, this time Y$ for up to 8Ø characters.*
1:	clr 717	*Sends* SDC *(Selected Device Clear) to clear the dvm and interface to the power up state.*
2:	wrt 717, "H1T3"	*Selects* H1 *mode and repetitive sample. A sample is initiated, further samples being inhibited until the measurement data is read.*
3:	red 717, Y$	*Measurement data from line 2 is read into Y$. On completion of data transfer a further sample is initiated.*
4:	dsp Y$	*Output data to display.*
5:	gto 3	*Return to line 3 and obtain data from the next completed sample.*

If HØ had been selected in line 1 (wrt 717,"HØT3") the dvm would have executed repetitive samples at the maximum rate (200 samples/sec typical). The data read at line 2 would then be a sample reading from one of those completed measurements; measurements completed during execution of lines 2, 3, and 4 would be ignored. This mode permits a maximum dvm measurement sample update with the listening device accessing only sample data from the numerous measurements taking place.

Selecting H1 when in LOCAL inhibits the SINGLE and REPETITIVE buttons for the period between measurement completion and acceptance of the measurement data by the listening device.

Handshake mode HØ is selected on power-up and by the Device Clear function.

Q – *SRQ (Service Request) Enable, an* **Interrupt** *facility.*

It is possible for the interface to interrupt the controller (via the SRQ line) after the completion of a sample. This is enabled by the message Q1 being sent to the 70755A. The message QØ disables the interrupt at sample completion.

The interrupt capability enables more complex, and flexible, measurement completion and data analysis programs to be written. It also permits efficient control, by Serial Polling, of several instruments on a bus.

The following example shows how data analysis and measurement times may be time-shared to improve program execution rate.

	Program Step	Action
Ø:	dim X$ [5Ø]	*Allocates a 5Ø character storage area, X$.*
1:	clr 717	*Sends* SDC *(Selected Device Clear) to clear the dvm and Interface to the power-up state.*
2:	oni 7, "SRQ"; eir 7	*Specifies that when a* GP-IB SRQ *interrupt occurs program control is transferred to subroutine* SRQ.
3:	wrt 717, "H1Q1T3"	*Selects handshake mode 1, interrupt enable and repetitive trigger.*
4:		*Lines containing user program to be executed whilst measurements are in progress.*
101:	"SRQ": red 717, X$	*The 70755A Interface asserts the* SRQ *signal whenever the dvm completes a sample. This assertion transfers control to the subroutine. The measurement data is read into the controller and a further sample is initiated by the dvm.*
102:	dsp X$	*Outputs data to display.*
103:	eir 7	*Reactivates the* SRQ *interrupt, enabling the next sample completion to be detected.*
104:	iret	*Returns to the interrupt point of the main program and continues.*

QØ, SRQ enable off, is selected on power-up and by the Device Clear function.

U – AC Setting delay.
Command 'U' allows the selection of AC settling delay in REMOTE.
'UØ' selects no AC settling delay in REMOTE.
'U1' selects 1 second AC settling delay in REMOTE.
The selection allows AC 'tracking' (UØ) or AC single samples (U1) to be performed.
NOTE: The 'REPETITIVE' (REP) button on the front panel must be selected to enable the UØ function.

E – *Echo-back*

Two types of echo back data may be selected, E1 or E2.

On receipt of the message string E1 the 70755A Interface assembles the measurement settings applicable to the last completed sample. This permits the actual measurement settings of the dvm to be accessed and also allows the front panel settings to be found.

On receipt of the device message string E2 the Interface assembles the current REMOTE settings. This permits verification of program strings and also allows a dvm to be slaved to the remote settings of another dvm.

The echo back information is stored until the Interface is instructed to Talk, when the settings will be output in the following format:

20 bytes M3 RØDØQØHØNØUØPØTØ CR LF ← Power-up / DCL / SDC state

This gives each program parameter letter followed by the value applicable to the last sample or the REMOTE value depending on whether E1 or E2 was programmed.

If both data and settings information is required from one sample it is necessary to access the measurement data first at the completion of the sample. This is because the measurement data is destroyed when the Echo data is assembled. This requirement also inhibits the use of continuous Trigger modes when both sets of data are required.

Sending the EØ to the Interface allows unread settings data to be cleared thus enabling further samples to proceed; EØ is selected on power-up and by the Device Clear function.

Refer to the example program (on page 2) for a typical use of the echo back facility.

REMOTE PROGRAMMING MESSAGES

M – *Measurement function*

With the 70755A Interface addressed as a listener the REMOTE function of the dvm can be selected by sending the ASCII character M followed by an ASCII number between Ø and 5. The following is a summary of the 6 programmable functions:

MØ – dvm Selfcheck mode.
M1 – kilohms
M2 – A.C. Volts
M3 – D.C. Volts
M4 – Ratio A.C.
M5 – Ratio D.C.

M3 is selected on power up and by the Device Clear function.

MØ – *Selfcheck*

There are five selfcheck measurements. After selfcheck is programmed the first measurement made is of 7V D.C., the second 0V D.C., third 10V A.C., fourth 10kΩ and fifth 7V D.C. This cycle is repeated with further measurements. Note that the fifth selfcheck is an all-the-eights check of the display circuit but repeats the selfcheck 1 internal measurement.

Summary:

selfcheck 1	7V D.C.	*The user should refer to the 7075 operating manual for limits applicable to these checks.*
2	0V D.C.	
3	10V A.C.	
4	10kΩ	
5	7V D.C. (Display check)	

When selfcheck measurement data is output it is preceded by the ASCII letter C to indicate that the data is from an internal measurement. (This character will be suppressed when N1 Numeric Format is selected).

M1,2,3,4,5

These functions are self explanatory and are as described in the dvm operating manual.

Note: It is advisable to program the function AFTER a suitable Range has been selected. If an illegal Range/Function combination is programmed an Error Interrupt will result.

R – *Range*

On receipt of the ASCII character R followed by an ASCII number between Ø and 7 the REMOTE measurement range of the dvm is selected.

RØ	–	Autorange		
R1	–	10MΩ	(KOHM mode only)	
R2	–	1MΩ	1000V	AC/DC
R3	–	100kΩ	100V	AC/DC
R4	–	10kΩ	10V	AC/DC
R5	–	1kΩ	1V	AC/DC
R6	–	100Ω	.1V	AC/DC
R7	–	10Ω	.01V	DC only

Autorange is selected on power-up and by the Device Clear function, also when dvm is in LOCAL control operation.

Range/Function Errors

From the above it will be seen that Ranges 1 and 7 have restrictions on the Functions for which they are valid. If an invalid Function/Range setting is programmed an Error interrupt will be caused and Error 3 will be set in the Serial Poll Status Byte.

It is advisable to pre-program a valid Range *before* selecting a new Function.

D – *Display Resolution (Integration time)*

On receipt of the ASCII character D followed by an ASCII number between Ø and 4 the following Display resolution (Integration Time) will be selected:

DØ	3 x 9's	1ms
1	4 x 9's	20ms
2	5 x 9's	100ms
3	6 x 9's	1s
4	7 x 9's	10s

DØ is selected on power-up and by the Device Clear function.

The format of the data output by the Interface does not change with different scale lengths. Eight digits are always output but digits defined as insignificant by the selected Display Resolution will be output as zero.

T – *Trigger Selection*

This input message controls the dvm sample initiation when in REMOTE and is analogous to the SINGLE and REP front panel buttons used when in LOCAL.

Trigger is selectable as either single or continuous (repetitive). Samples are started either immediately on receipt of the Trigger message or on receipt of the Addressed Bus command GET (Group Executive Trigger). The four possibilities are summarised below:

TØ	GET triggered single sample
T1	GET triggered repetitive sample
T2	Immediate single sample
T3	Immediate repetitive sample.

Normally the T command will be the last sent to the Interface in a command message string and will initiate the programmed measurement samples.

TØ is selected by power-up and by the Device Clear function.

P – *Preset*

This function is reserved for future development. The 70755A interface will only accept the message PØ (preset off). Any other preset value will cause an input Error Interrupt and set Error 4 into the Serial Poll Status Byte.

Summary of Input Commands

Nn Measurement data format, where n = '0' indicates full alphanumeric output; n = '1' specifies deletion of the 6 character alpha header.

Hn Handshake mode; n = '1' slows dvm down to speed of listening device; n = '0' permits dvm to operate at normal speed regardless of speed of listener.

Mn Measurement Function, where n has the following significance:
Ø = Self Check
1 = Ω
2 = VAC
3 = VDC
4 = Ratio AC/DC
5 = Ratio DC/DC

Dn Display (Integration time/Scale length), n having the significance:

Ø = 1ms	3 x 9's
1 = 20ms	4 x 9's
2 = 100ms	5 x 9's
3 = 1s	6 x 9's
4 = 10s	7 x 9's

Rn Measurement Range, n signifying:

Ø = Autorange			
1 = 10MΩ			
2 = 1MΩ	or	1000V	DC/AC
3 = 100kΩ	or	100V	DC/AC
4 = 10kΩ	or	10V	DC/AC
5 = 1kΩ	or	1V	DC/AC
6 = 100Ω	or	0.1V	DC/AC
7 = 10Ω	or	0.01V	DC only

Qn Service Request (SRQ) enable; n = '1' = enable, n = '0' = inhibit.

Un AC Settling Delay; n = '1' for AC Tracking; n = '0' for AC single samples.

En Echo facility; n = '1' commands the dvm to 'echo back' the settings applicable to the last completed measurement; n = '0' cancels echo-back.

Tn Trigger Mode, where n signifies:
Ø = Single sample on receipt of GET*
1 = Continuous sample on receipt of GET
2 = Immediate single trigger on receipt of T2.
3 = Immediate continuous trigger on receipt of T3.

* GET = Group Execute Trigger

DATA FORMATS WITH INTERFACE IN TALK MODE

Normally when the 70755A Interface is addressed to Talk to the bus it will output measurement data from the last completed sample. If however the echo command is being obeyed the data output will be followed by the settings applicable to the E command being executed.

Once the Interface has been addressed to Talk all the data relevant to the current output message are stored. Until all of the data are output (including the delimiting characters) no new data will be assembled. This facility enables high priority interrupts to be made on the bus without loss of data from the dvm. However it does mean that if H1 mode is in operation (LOCAL or REMOTE) no new sample will be allowed to proceed until all of the data, including delimiting characters, are accepted by the listening device. SDC or DCL (Device Clear commands) clears the output data buffer with the resultant loss of any stored data.

MEASUREMENT DATA

Alpha Header characters

If Numeric format OFF is selected (see page 5) 6 Alpha Header characters are output preceding the numeric measurement data. These characters give information about the data.

The first character can be either:

O, U, C or Space

O signifies that the measurement is invalid due to overload on the dvm inputs. i.e. $>$ 1.4 x Range max.

U signifies that the measurement was made on a higher range than necessary and that it is not to full resolution (this will normally only appear if a fixed range is remotely programmed) i.e. $<$ .12 x Range max.

C signifies that Selfcheck mode is selected.

Space character signifies that the measurement is valid and is not a Selfcheck sample.

The next 4 characters give the mode (Function) on which the measurement was made and is one of the following 4 groups:

KOHM	kilohms
VAC Sp	Volts A.C.
VDC Sp	Volts D.C.
RAC Sp	Ratio A.C.
RDC Sp	Ratio D.C.

Sp represents an ASCII space.

The sixth character of the Alpha header set is *always* an ASCII space.

Numeric Data Format

The numeric data is in 8 significant digit floating point format:

e.g. + 1.2345678E+03

The sign characters are either ASCII + or – as appropriate. The decimal point is adjusted to give an exponent in factors of 3.

e.g. 1.6 volts gives + 1.6000000E+00
–0.9 volts gives – 900.00000E–03

The range of the exponent is from +6 to –9.

Insignificant trailing digits are always 0.

ECHO DATA

Echo data are immediately assembled following the received E1 or E2 message, any remaining data being stored for output by the Interface will be deleted and replaced by the echo back data; this includes unread measurement data. It is therefore necessary to read this, if it is required, before programming the echo back function.

The echo data is of the form

M3 R5DØQØHØNØUØPØTØ CR LF

All of the settings are output every time the E message is received. Each setting is preceded by its characterising letter (M–Mode, R–Range etc) and followed by its current setting or result from the previous measurement sample.

For E1 data Mode, Range and Display resolution are obtained only from a completed measurement and are valid in LOCAL only after a measurement has been completed.

For E2 data the settings are the currently programmed REMOTE settings.

(P – is a Preset mode, reserved for future expansion).

DELIMITING CHARACTERS

Each data message string is terminated (delimited) by switch selectable characters. Normally CR LF characters will be selected as standard.

The switch is located on board 70759531, the upper board of 3 within the interface and the first 3 rockers (1-3) are used to determine the delimiting characters. The ON and OFF* are as marked on the switches.

*Some of the switches used are marked "OPEN" instead of "OFF".

Option	Rocker 1	Rocker 2	Rocker 3	Delimiting characters
(1)	off	off	off	;
(2)	off	off	on	CR LF default
(3)	off	on	off	ETX
(4)	off	on	on	CR LF ETX
(5)	on	off	off	EOI with last data character
(6)	on	off	on	CR LF (plus EOI)
(7)	on	on	off	ETX plus EOI
(8)	on	on	on	CR LF ETX (plus EOI)

Notes 1 ETX is the ASCII ETX char (decimal 3)

2 EOI is the Bus End or Identify signal which used to flag the last character of a data message. The EOI signal is asserted at the same time as the DIO signals carry the last character of the data string.

3 Option (2) is selected as standard.

4 Options (7) and (8) are not normally used because EOI and ETX are alternative delimiting characters.

Summary of Output Data

Measurement data is formatted as an alpha-numeric string, thus:

_____Sp. + 1.2345678E + ØØ [delim] 22 bytes

①② ③ ④ ⑤

in which:

① is a validity indicator, O = overload, U = underflow, C = Self check and Sp = valid

② a four letter indication of measurement function, viz: VDC Sp, VAC Sp, KOHM, RDC Sp, RAC Sp.

③ polarity '+' or '–'.

④ measurement data in exponent form to 8 significant digits (i.e. 1 more than maximum display resolution!) E within the range –9 to +6.

⑤ delimiters, are user selectable from:
"CR LF", ";", "ETX" — these ASCII characters can be selected alone, or in conjunction with EOI.*
or EOI — as a single delimiting character.

Echo-back information is in the form:

M3 R4DØQØHØNØUØPØTØ CR LF

which is readily translated as DC, 10V range, 3 x 9's, SRQ inhibit, handshake OFF, full alphanumeric output, single trigger on receipt of GET. (P. a preset mode, is not currently implemented)

'Echo' instruction will also provide a read-out of the front panel settings if the dvm is in LOCAL. In that event, the program parameter information will be omitted.

* EOI = End or Identify

SWITCH SELECTABLE OPTIONS

INPUT DATA PARITY

The parity bit on input data is ignored by the 70755A interface.

OUTPUT DATA PARITY

Output parity is switch selectable. The switch is located on board 70755035, the middle board of the 3 within the Interface. There are two switches on this board, the Parity switch is SW2. Rockers Nos 3 and 4 should always be off as these select Test conditions when ON.

The parity options are shown below

Option	Rocker 1	Rocker 2	Parity bit
(1)	off	off	Always off (0)
(2)	off	on	Even Parity
(3)	on	off	Odd Parity
(4)	on	on	Always on (1)

Option (1) is set as standard.

DELIMITING CHARACTERS (See page 12 for details).

INTERFACE ADDRESS

The bus address of the 70755A Interface and dvm is selectable by means of a 4 pole switch on board 70755035, SW1 is the address switch. The least significant 4 bits of the address are selectable giving an address range of ASCII 0 to > for Listen Addresses and ASCII P to ↑ for Talk Addresses.

SW1 Rocker				ASCII	
4	3	2	1	Listen	Talk
off	off	off	off	0	P
off	off	off	on	1	Q
off	off	on	off	2	R
off	off	on	on	3	S
off	on	off	off	4	T
off	on	off	on	5	U
off	on	on	off	6	V
off	on	on	on	7	W
on	off	off	off	8	X
on	off	off	on	9	Y
on	off	on	off	:	Z
on	off	on	on	;	⊏
on	on	off	off	<	\
on	on	off	on	=	⊐
on	on	on	off	>	↑
on	on	on	on	Talk or Listen Active Always (see Text)	

Notes 1 Only 15 addresses may be used, as the 16th character in the Talk address column is defined as UNT (Un Talk).

2 Only the odd addresses of the Interface are selectable, the even addresses being ignored.

The standard preset address will be: 17

ASCII 1 Listen Address

ASCII Q Talk Address

This translates into the folowing calculator bus address codes:-

1. HP9825A – 717
2. HP9815 – 17
3. Tektronix 4051 – 17

The same address is used in both "WRITE" and "READ" statements. The calculator internally computes the correct Talk and Listen Address characters.

Talk or Listen Active Always

In the situation where it is required to implement a bus system with only simple peripherals (e.g. listen-only printers or tape punch) it may be useful to set the interface to Talk (or Listen) always. This means that it is not necessary to have a controller capable of sending Talk and Listen addresses to implement a simple data path between, e.g. dvm (in Local only) and a printer.

Selecting the 16th address (all rockers 'on') sets this mode, which is equivalent to having the Interface always addressed as a Talker or Listener. All other facilities remain unchanged assuming the bus limitations of this situation.

Either Talk Always or Listen Always is selected by SW1 board 70759531 Rocker No. 4

on – Talk Always

off – Listen Always

Note. Listen Always is not particularly useful as this by definition inhibits outputting of data.

Summary of Switch Selectable Facilities

Parity: Even, odd, always set or always cleared.

Instrument address: one of 15 unique ASCII codes.

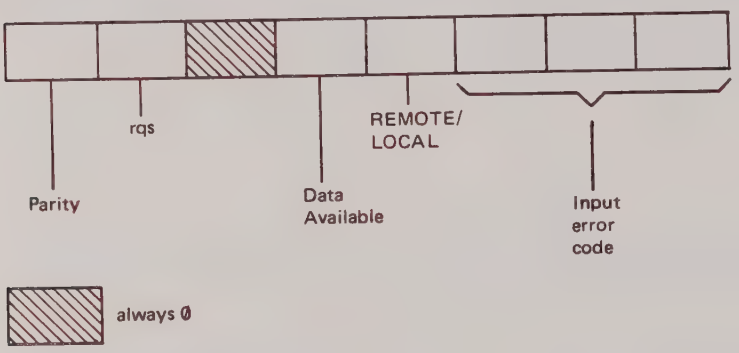
Talk only: the dvm can be permanently held in the data output mode (for use in a simple system with one 'listening' device only).

SERIAL POLL AND STB (Status Byte)

Implementation of the Serial Poll facility is as per the IEC specification.

The SRQ signal is released by the 70755A Interface after the Status Byte is output.

The STB (Status Byte) which is output by the Interface during a Serial Poll is of the following form:



rqs – *Request Service*

This bit is set if the Interface is requesting service because of either an input error or as the result of the completion of measurement sample.

Data available

This bit is set if data is available (in whole or in part) for output.

REMOTE/LOCAL

This bit is set if the DVM is in LOCAL and clear if in REMOTE.

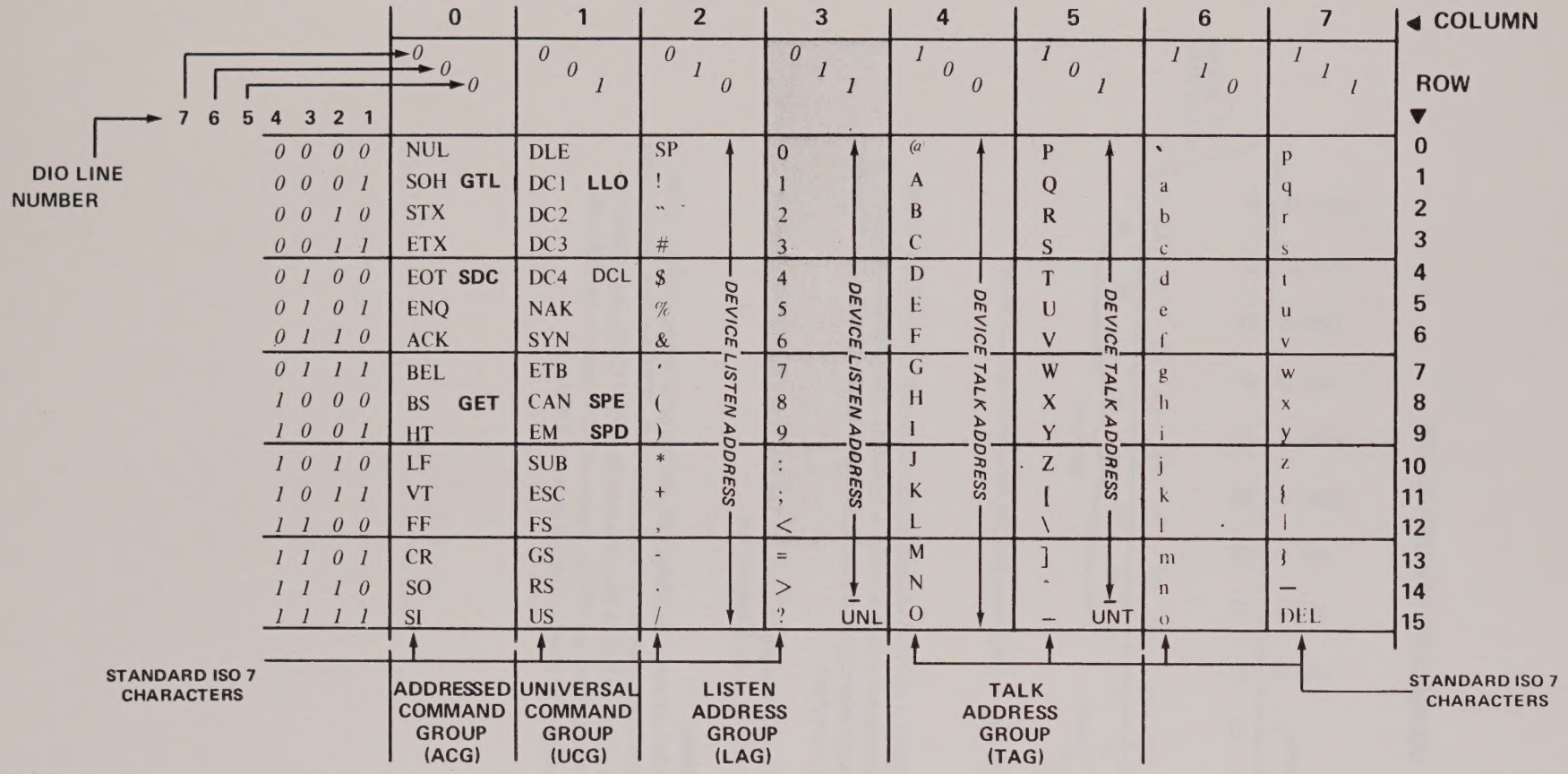
Input Message Error Code

When the data received by the Interface is not understood, or programs an invalid condition, or is out of range, SRQ (Service Request) is asserted which may be used to interrupt the bus Controller. The Error code set in the Status Byte will indicate the source of the error:

Error	STB Code	
Ø	0 0 0	No error
1	0 0 1	Reserved
2	0 1 0	Reserved
3	0 1 1	Illegal Mode/Range combination
4	1 0 0	Preset Error – No preset facility
5	1 0 1	Argument Error – Illegal input value
6	1 1 0	Reserved
7	1 1 1	Reserved

Error 5 is produced if the numeric value following an Alpha character is out of range for the Alpha character setting.

See page 9 for details of Error 3.


COLUMN
ROW
DIO LINE NUMBER
7 6 5 4 3 2 1
0 1 2 3 4 5 6 7
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
NUL DLE SP 0 @ P ` p
SOH GTL DC1 LLO ! 1 A Q a q
STX DC2 " 2 B R b r
ETX DC3 # 3 C S c s
EOT SDC DC4 DCL $ 4 D T d t
ENQ NAK % 5 E U e u
ACK SYN & 6 F V f v
BEL ETB ' 7 G W g w
BS GET CAN SPE (8 H X h x
HT EM SPD) 9 I Y i y
LF SUB * : J Z j z
VT ESC + ; K [k {
FF FS , < L \ l |
CR GS - = M] m }
SO RS . > N ^ n ~
SI US / ? O _ o DEL
DEVICE LISTEN ADDRESS
DEVICE LISTEN ADDRESS
DEVICE TALK ADDRESS
DEVICE TALK ADDRESS
UNL
UNT
STANDARD ISO 7 CHARACTERS
ADDRESSED COMMAND GROUP (ACG)
UNIVERSAL COMMAND GROUP (UCG)
LISTEN ADDRESS GROUP (LAG)
TALK ADDRESS GROUP (TAG)
STANDARD ISO 7 CHARACTERS

Notes. 1. The shaded columns, 3 and 5, are the LISTEN & TALK addresses for Solartron instruments. Columns 2 and 4 are not used as such by the Solartron implementation of TC66.

2.

Table A.1. The ISO-7 Character Table, as applied to the IEC Interface

APPENDIX 2. CONNECTOR SPECIFICATION

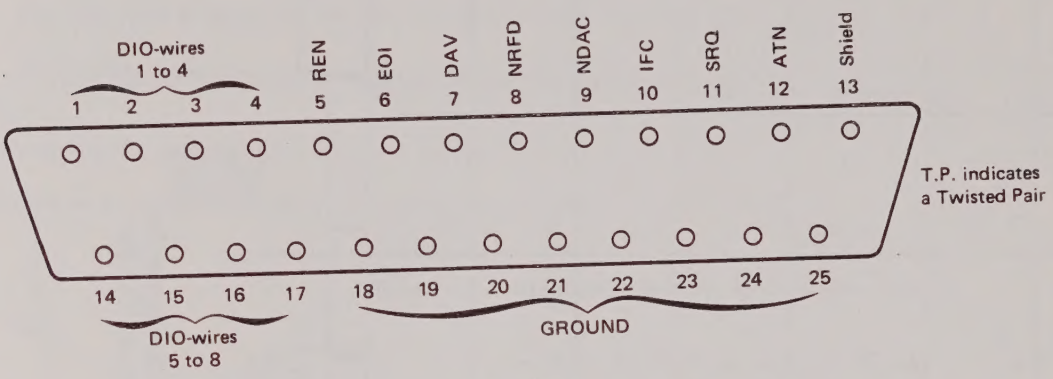


Fig. A1 Pin connections for the Cannon DB-25S socket.

The connector required for the 70755A Interface is a Cannon D-type, DB-25S, 25-way socket. The pin designations are as shown in Fig. A.1 (above). The ground connections on pins 18 to 25 provide earth return paths for the signal lines 1 to 12 and 14 to 17. A separate Shield connection is also provided.

Four cables are available, of length 1m, 2m, 3m and 4m. They should be ordered by Part Number, viz. 31201A, B, C and D respectively.

International compatibility

It should be noted that the connector illustrated, and the cable forms, conform to the IEC Standard. American connectors, however, conform to the IEEE standard, which differs from that of IEC. An adaptor, IEEE-to-IEC, Solartron Part No. 31202A, is available for those users who may wish to interface 7075 to equipment conforming to the IEEE488 standard, using IEC cables. The adaptor wiring is shown in Table A2.

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